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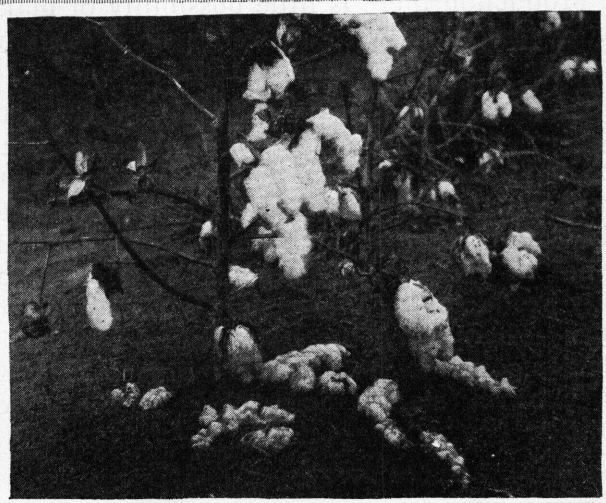
COMMON ERRORS IN COTTON PRODUCTION



IMPROVEMENT of cotton production in the United States depends largely upon getting rid of numerous errors in production practice which are widely current and commonly overlooked, even among well-informed people.

General disregard of quality in cotton buying, effects of mixing and changing seed, of planting inferior varieties, and of carelessness in handling and ginning the cotton are discussed in this bulletin.

Progressive farmers and local leaders are advised to direct their efforts toward establishing community production of single varieties of cotton. Without such production there is little possibility of making effective use of superior varieties or of obtaining advantage from other improvement measures.

In the absence of any domestic use for raw cotton a higher return from his cotton is the only benefit which the farmer can expect from improvement of its quality. If better varieties are to be grown extensively, cotton must be bought on a basis of quality and not at "hog-round" prices. Organized community production of one variety will facilitate this change. There can be no assurance of better prices for better cotton except in communities which produce uniform standardized fiber in commercial quantities.

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COMMON ERRORS IN COTTON PRODUCTION

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MISTAKES THAT INTERFERE WITH PROGRESS

COTTON growers hold several mistaken ideas which interfere with the adoption of improved methods and varieties, and thus tend to keep the producing industry backward and wasteful. Mongrel seed is planted, millions of bales of inferior cotton are produced, cultural practices that invite weevil injury are used, and careless handling and bad ginning do great damage. Much cotton must be sold without proper discrimination of quality[1] in the primary markets and without adequate encouragement to farmers who have tried to improve the quality of their crop.

Some of the popular beliefs are supported by arguments that appear reasonable and have been held so long without challenge that they now have the force of accepted traditions. Thousands of farmers plant the varieties with the shortest lint and are certain that such varieties always give the highest yields, although they often do not, as many experiments have shown. The mistake no doubt arises from the fact that some of the very short varieties give high turnouts at the gin, though the yields per acre often are lower than in varieties that produce longer and better lint. The mistake of planting poor seed instead of using good varieties affects the entire cotton industry and entails a loss every year of many millions of dollars.

Probably a large proportion of farmers still have confidence in the idea that cotton varieties inevitably "run out" and that a

[1] Much remains to be done in determining precisely what is meant by "quality" as related to cotton and its utilization. Progress is being made in a cotton research program of the U. S. Department of Agriculture, which, in cooperation with various Federal, State, and other agencies, embraces cotton fiber and spinning studies by the Bureau of Agricultural Economics.

change of seed is required every few years. The notion of changing the seed undoubtedly is responsible for much mixing and mongrelizing of seed stocks and consequent deterioration of the fiber.

Such errors are not confined to farmers and cotton buyers, but are shared by many economists, engineers, and statesmen. Even many professional writers on farm improvement, plant experimenters, and cotton breeders reflect the traditional views. Bankers, factors, and merchants who lend money to the farmers are often completely misinformed on seed questions and in recent years have suffered with the farmers through overproduction of inferior fiber. In view of such losses it is remarkable that they should continue to advance millions of dollars every year for the production of inferior cotton, without giving more consideration to the need for improvement.

Information, advice, or instructions for improving the cotton crop can be of little use while farmers continue to believe that they can get larger returns from poor varieties, and that they should have the ginner "skin" the seeds in order to increase the bale weights. Little interest in quality is felt by farmers who have contracted beforehand to deliver so many bales of cotton at a specified price to cover their loans. The causes of such backwardness must be recognized and removed before the farmers can be expected to apply themselves seriously to the improvement of their crop. Indeed, they sometimes prefer to have their cotton as poor as possible, as this has been their only way of retaliating against the unfairness of the commercial system.

Improving the quality of the domestic cotton crop is important in meeting the competition from cotton grown in other countries and sold in the world market, as well as in giving domestic manufacturers a better staple. Very short fiber grown in the the United States must be sold in competition with cotton grown in India and China, or it must be held as a surplus stock in this country which tends to depress prices.

Gradually increasing cotton production is reported from several regions. In Cotton and Cotton-Oil News, January 6, 1930, the following statement was made:

A glance at the daily spot sales in the Liverpool market is enlightening. Without going very far back or digging deeply into the matter, it is evident that foreign cotton is playing a great part in the dealing there. For some time it has been a regular occurrence to see the sales of foreign cotton amounting to 40 or 50 per cent of the daily total. It is at least interesting to note the details of the stocks of cotton held in Great Britain at the end of November this year and last year, as follows:

	1929	1928		1929	1928
	Bales	*Bales*		*Bales*	*Bales*
Brazilian	66,810	24,000	East African	47,740	42,000
Peruvian	99,770	71,000	West African	21,920	9,000
Egyptian	47,040	53,000	Australian	330	2,000
Sudan	80,910	42,000	East Indian	39,520	38,000
West Indian	3,650	1,000			

CAUSES OF DETERIORATION

Two important agencies of deterioration existed in the cotton industry for many years without being recognized, and even yet their adverse effects are only partially understood by cotton growers generally and still less by the manufacturers. The public gins and the commercial system of indiscriminate buying have been responsible for a deterioration in the quality of the American cotton crop. Indeed, it is hard to understand how their effects upon the crop could have remained so long unrecognized. Some of the errors that affect production undoubtedly are deeply embedded in the commercial system and are hardly to be removed unless the methods of buying cotton can be changed.[2]

Although mechanically more efficient than the old plantation gins in handling large quantities of cotton, the present-day public gins have serious drawbacks in the fact that in them the cotton and the seed from different customers are mixed together, and this undoubtedly is a general cause of deterioration of the crop. Different kinds of cotton follow each other at the gin, and "plated" bales and mixed seed stocks result.

To maintain pure stocks of seed, individual farmers must not only isolate the fields where seed for planting is grown but must take special precautions against mixing the seed at the gins.

The present buying system does not encourage production of a better quality of cotton because, on many primary markets, the crop is bought at "hog-round" prices, with no discrimination between staple lengths or qualities of the fiber. Price levels may be higher in districts reputed to produce fiber of better quality, but this usually does not mean that the individual growers of good cotton can sell at a better price than the growers of poor cotton. It is easier and more profitable to the cotton buyer to buy in this manner. Buyers say they favor the production of better fiber, but they seldom offer the practical encouragement of a better price for it. The farmer who produces fiber worth from 2 to 5 cents a pound more than a neighbor's cotton raised from gin-run seed may have to sell his cotton at the same price that the neighbor's cotton brings, because the buyer refuses to consider quality and offers only one price, which the farmer must take or leave. Under such conditions the farmer naturally remains indifferent to the possibilities of producing better fiber.

It may be argued that indiscriminate buying is appropriate to the present method of production from mixed and miscellaneous seed stocks. Each farmer's bale may be different from his neighbor's, and mixed or "plated" bales are frequent, even when there is no intention to swindle the buyers. Plated bales may have to be repacked before they can be marketed, and this is a costly operation. Bales are not classed to any great extent in the primary markets, but at the trade centers where thousands of bales are assembled and the work can be done rapidly.

Much cotton is grown on advances of borrowed money, but banks and other financial agencies have not taken a constructive interest in the quality of the crop. Little change in the economic phases of

[2] For a fuller discussion of this subject see U. S. Department of Agriculture Bulletin 60, The Relation of Cotton Buying to Cotton Growing.

cotton growing has taken place in the two generations since the Civil War. In the early days of the boll-weevil invasion it was thought that the industry might be freed from the crop-loan system, but the system has spread into new cotton-growing areas north and west, and has even extended gradually to the production of other crops, especially in the cotton-growing area.

Cotton growers have had to submit to the commercial exactions because in many districts cotton was the only money crop, the only farm product that would bring a cash return for meeting the family needs. In many cases there is no practical alternative to selling the cotton as soon as it is in the bale, if indeed it is not already hypothecated by crop loans, so that it must be turned in at once for what it will bring.

Manufacturers have sometimes been blamed for not cooperating with the growers in their efforts to improve their crop. In many districts the manufacturers have made such efforts, but the inertia of the buying system is so great that the manufacturer as well as the farmer has suffered from the buyer's failure to discriminate between grades of cotton.

GENERAL MEASURES OF IMPROVEMENT

CHANGING THE METHOD OF BUYING COTTON

Manufacturers who require cotton of good quality would seem to have the most direct interest in the improvement of production. Improved varieties are now available with staple an inch or more in length, which usually are as productive as varieties with less than inch staple. The reasons for continuing to produce millions of bales of very short and irregular cotton are not agricultural, but lie in the commercial features of the industry. It is here that the understanding and cooperation of manufacturers are especially needed, in order to extend the production of longer staples. The following statement regarding the effects of marketing on production was included in the writer's address before a meeting of the National Association of Cotton Manufacturers at Atlantic City, N. J., May 24, 1929:

> If the cotton were sold by the farmers in the same way that it is sold to the manufacturers, there would be little difficulty in increasing the production of better fiber. The manufacturer who buys staple cotton expects to pay more for it, but under the existing system the buyer, rather than the producer, takes the premium that the manufacturer pays for superior fiber. The farmer who plants a better variety is expected to sell his longer and more uniform fiber at the same flat price that is paid to other farmers for the short and irregular fiber raised from ordinary gin-run seed. The fiber raised from the good seed may have an intrinsic value several cents per pound above ordinary short cotton, but under the usual conditions there is little encouragement to produce the better fiber, since the farmer who plants seed of a good variety usually is unable to sell his cotton to local buyers at any appreciable advance above the local quotations for the ordinary short cotton. The work of "classing" the cotton, to determine the staple length and character of the fiber in the bales, in order to sort the bales into "even-running" lots, is not done before the cotton is purchased from the farmers, but after the cotton is assembled at the shipping points.
>
> No doubt many of you are familiar with these elementary facts regarding the system of buying the cotton from the farmers at flat prices and with the subsequent operations of "classing out" the bales and making up the com-

mercial lots at the various shipping points. But it may be that some of you have not reflected upon these features of the industry from the standpoint of the farmer or asked yourselves the direct question how much improved cotton you would plant after you had learned by experience that you would be obliged to sell it at the same flat price that your careless neighbor would get for the product of his gin-run seed. If a yard or a pound of fine cloth had to be sold at the same price as coarse cloth, how many manufacturers would persist in making the fine fabrics?

It is a remarkable feature of the cotton industry, the buying of cotton with so little discrimination of quality in the primary markets. But the system actually exists and serves as a very definite restriction upon the planting of better varieties. Moreover, the system is old and of long standing, so that nobody now alive can be blamed for starting it. Probably it never was started consciously, but grew up gradually with the expansion of the industry.[3]

If the buying system had been planned in the interest of the manufacturers, the quality of the fiber undoubtedly would have been a controlling factor; but the buying system became entirely separate from the manufacturing system. In reality the three fields of activity—production, buying, and manufacturing—have worked as separate systems and not in constructive relations with one another. The buying system unconsciously interferes with the improvement of production and keeps the manufacturers from being supplied with better raw material.

The buying system has worked to its natural result, except in a few districts where the growers have found means of resisting its general tendencies.

ORGANIZING 1-VARIETY COMMUNITIES

Fortunately, there is a simple improvement in production which can aid in bringing about, with no great difficulty, a constructive change in the marketing of cotton. Communities of progressive farmers can avoid many difficulties by the simple expedient of restricting themselves to a single variety of cotton in each district. Adequate stocks of pure seed are maintained in such communities, since only one kind of cotton is brought to the gins or planted in the fields, and the usual mixing and mongrelizing of the seed stocks is prevented.

In a properly organized community all the farmers are supplied with planting seed of the same quality, so that the most important step toward standardizing the crop is taken in advance. Except as the cotton may be damaged by adverse conditions of growing or handling, fiber of uniform character is produced by the entire community, in sufficient bulk to give it a commercial status, thus facilitating cooperative marketing.

It is of no advantage, either to growers or to manufacturers, that the production of cotton should be conducted by the present haphazard methods which prevent the farmer who raises good cotton from getting a price advantage. Community production of one variety is the best preliminary to cooperative marketing and offers a substantial basis for the future progress of the cotton industry. The present system often gives the growers of inferior short staples an unfair advantage over their neighbors who are growing better

[3] For an abstract of this paper see Manufacturers' Record, May 30, 1929.

fiber, but even these short-staple growers might be on a better footing if the community as a whole could improve its production.

The first communities were organized in the irrigated valleys of the Southwestern States where cotton growing was a new industry and demonstrated their advantages. Special cooperation on the part of the United States Department of Agriculture has been extended to several communities that have undertaken to develop and maintain supplies of pure seed of one variety. A single variety community has existed in the Coachella Valley in southern California since 1920.

The supplies of pure seed developed and maintained in the organized communities have served largely as the basis of production in all the irrigated districts where cotton was grown in western Texas, New Mexico, Arizona, and California, with a further acreage below the Mexican border, in Lower California.

In the eastern Cotton Belt the reaction of a farming community to the payment of premiums for improved fiber is demonstrated by the development of a center of production of long-staple cotton at Hartsville, S. C., through the efforts of D. R. Coker, covering a period of about 30 years. By combining the two functions of breeding the seed and marketing the cotton, a local production of about 40,000 bales of superior staple has been developed, and large quantities of improved seed have been furnished to other parts of the Cotton Belt. In a district that was not considered especially adapted to the production of long staples, the fiber length has been increased from less than an inch until much of the crop is from 1⅛ to 1¼ inches long. Premiums sometimes as high as 50 per cent above the value of short cotton are paid to farmers in the Hartsville district, and the increment of value resulting to this community from these improvements of production and marketing is estimated at $1,000,000 a year.

This development shows the need of responsible intermediaries between the growers and the manufacturers, to meet the requirement of "correct and fair buying at the primary market," which is recognized by Mr. Coker as "the first approach to this question of quality production." The system followed elsewhere of taking improved cotton from the farmers as cheaply as they can be forced to sell it has seemed good business practice for the buyers, but certainly it does not lead to improvement of production. The commercial handling of the good cotton should cost no more than the handling of poor cotton, and may even cost less, since less speculative risk is involved. The former Sea Island crop, the most valuable cotton in the world, was handled at $2 a bale, according to local reports in Charleston and Savannah.

Both seed-supply and marketing problems can be simplified greatly by community organization of production. Assurance of fair prices for the good cotton is fundamental. The farmer must know that he will get the real value of his cotton, or at least the actual market value, and that he will not be exploited by the buyer. The results that have been obtained in a few years in some of the 1-variety communities show that such organization of production opens many new possibilities.

SOME CAUSES OF INFERIOR COTTON

PLANTING POOR SEED

The immediate cause of producing inferior cotton is the planting of poor seed. Most of the cotton crop in the United States is grown from inferior gin-mixed seed that should be sent to the oil mill. Reports issued by the Bureau of Agricultural Economics show that the fiber of nearly 80 per cent of the American cotton crop is less than an inch long, and only 5 per cent attains 1⅛ inches. The producing system as a whole is wasteful in the extreme, since many of the losses could be avoided. Lack of good seed may be considered as a reason why poor seed is planted, but the difficulties of providing the good seed are inherent in the present producing system. The fiber produced from most of the seed now planted is inferior in two respects, in being both short and irregular. The need of uniformity is always admitted, whether for short or for long fiber, but the requirements for maintaining uniformity, as well as for producing good staple, have been neglected.

Superior varieties, which have fiber an inch or more in length and which are not outyielded by the shorter varieties, are now available. No agricultural reason has been found for continuing to plant varieties with less than inch staple in any cotton-growing district of the United States. The practical reasons for planting the varieties with the very short staples is that they may be found more profitable under the present marketing system. Some of the varieties with very short lint give high percentage turnouts at the gin, but commonly do not yield more pounds of lint per acre than do varieties with longer and better fiber. Higher yields are reported in some of the tests with the short, high-turnout varieties, but in other cases the yields are lower than from good-linted varieties. It is recognized that the very long staples, above 1¼ inches, are usually less productive than those with shorter fiber, though even the long-stapled Egyptian cotton often outyields the upland varieties in Arizona.

JUDGING VARIETIES BY TURNOUT AT THE GIN

One of the most frequent and costly errors among cotton growers is to confuse high turnouts at the gin with high production in the field, although the two are essentially distinct. The popular belief in the greater productiveness of very short staples may be explained as a carry-over of the idea from gin turnout to yield.

The gin turnout of fiber is figured as a percentage of the weight of the seed cotton before ginning. Higher turnouts tend to reduce the costs of picking and ginning, which are paid by the hundredweight of seed cotton, but this slight advantage may be more than overcome by lower yields or by inferior quality of the fiber, which in some high-turnout varieties is very poor. The highest turnouts occur with small or light seeds, which are not desirable. The farmer naturally is anxious to have the percentage of lint as high as possible, but it is a mistake to consider the turnout as of exclusive importance.

The tendency to confuse the gin turnout with the yield was recognized and challenged many years ago, as shown by the following statement of R. J. Redding, director of the Georgia Agricultural

Experiment Station, under date of 1893, quoted by J. L. Watkins in King Cotton:

> It is a very prevalent belief that a variety of cotton that will yield the larger proportion of lint to the hundred weight of seed is to be preferred. This belief is based on the assumption that a large yield of lint in proportion to seed indicates a large yield of lint per acre. It is a plausible theory, but experiments show that there is no relation between the yield of lint per hundred pounds of seed cotton and the total yield of lint per acre.

A similar statement is found in Georgia Agricultural Experiment Station Bulletin 20, Fertilizer, Culture and Variety Experiments, Corn and Cotton.

As long as the very short fiber can be sold at the same price as fiber of better quality, the high-turnout varieties have a slight advantage for the farmer in the lower costs of picking and ginning. Unless a market discrimination in favor of better fiber can be established, increased production of better cotton can not be expected. The extra care necessary in regular production of good cotton will not be taken without the inducement of a better price.

Less advantage would be seen in growing the poor varieties if ginning charges were based on the weight of the fiber removed, instead of on the weight of the seed cotton. The picking cost per pound of short-fiber lint may be somewhat lower on account of the lint percentage; but on the other hand the bolls of the high-turnout varieties are rather small, so that picking costs may be higher.

ARGUMENTS REGARDING SHORT STAPLES

It is often taken as a self-evident fact that varieties with very short staples yield larger crops than varieties with good staples. People with this ingrained belief are surprised that anyone should doubt it even enough to make actual yield comparisons in order to determine the facts, and when such comparisons are made and reported the evidence is still regarded as something "against nature."

From a scientific standpoint there is no biological principle to support such an argument—that yields must be greater because the fibers are very short. Stated in this way, the argument leads to an absurdity, and in practice it has encouraged production of cotton varieties having fibers too short to spin, so that the product is no longer suited to normal textile uses, for which it is hardly to be considered as real cotton, but rather as an adulterant.

It could be argued biologically that more lint would be obtained by making the individual fibers longer than by making them shorter. The biological fact is that the very short cottons that give the high turnouts at the gin have small seeds, altering the proportion of lint weight to seed weight. Also much of the material that goes into the bale from some of the short varieties is not really lint fiber, but fuzz fibers which are longer than usual and are ginned off with the lint fibers. It is not without propriety that the product of Half-and-Half and related varieties is often called "buzz-fuzz," since the fuzz fibers in normal varieties are distinct from the lint and are not removed in ginning, but pass with the seeds to the oil mill.

Better varieties than the market has justified are planted in some districts. The Texas big-boll type has not been replaced in Texas by varieties having inferior fiber, although many attempts to do so

have been made. This type of cotton has retained its popularity because it is better adapted to growing conditions in that State, yields more, and has larger bolls, also because of its "storm-proof" quality of holding the fiber for long periods in the open bolls instead of allowing it to fall or to string out from the bolls as does that of short-fiber varieties.

PLANTING ON PRICE CONJECTURES

Many farmers do much figuring on price quotations, assuming that varieties or acreages should be changed from year to year to meet supposed alterations in the market demands for longer or shorter staples. Seed dealers often repeat such arguments, or money may be lent freely for planting high-priced cotton in boom periods. Production may thus be made as speculative and hazardous as playing the market on futures, and often the varieties are changed for reasons that are entirely erroneous. In reality, the farmer has no way of knowing what the price of cotton will be several months in the future nor whether high premiums will be paid for longer staples in the following season. Speculative guessing and changing of varieties loses the advantage that might be obtained from a regular production of one kind of cotton.

Very high premiums sometimes may be paid in seasons of scarcity to meet special orders from manufacturers, but they afford no assurance that larger quantities of the longer staple will be called for in the following season. A deficient supply of cotton may restrict the demand instead of increasing it. The danger of having to pay excessive prices naturally tends to discourage manufacturers from making the goods that require a special quality of cotton. Fluctuations in premiums may result from temporary scarcity in particular long-staple districts, and the actual demand in the following season may be met from the usual sources, leaving no market for farmers who have planted extra quantities of the long staples. Even at very low prices, buyers may not be interested in handling small lots of longer fiber from new sources.

A stabilized production of good cotton is the real need and calls for a consistent policy of improvement in the American cotton industry. A large potential demand for better staple undoubtedly exists, and should not be confused with seasonal fluctuations in the premiums quoted for staples of different lengths. The occasional high premiums are much less important than a wider production of cotton of better quality. Regular supplies of good cotton must be available before adequate uses can develop. A gradual adjustment may be expected, not a sudden demand for a greatly increased production of longer staples. The premiums may go down if more long cotton is in sight than the mills are ready to use, but the low prices may be followed in turn by a gradually increased demand. Manufacturers are agreed that much larger quantities of good fiber would be used if it were known that the needed supplies would be available at reasonable prices.

Community production of one variety of cotton leads toward a gradual, sustained improvement in the quality of the fiber. Districts that establish a regular production of good fiber may be sure that better prices can thus be obtained over long periods of time, than

by changing and mixing the varieties. The kind of cotton that the community can plant to the best advantage should be determined with careful consideration of the best indications of supply and demand through a term of several years, and the farmers in organized communities should be advised to follow regular courses from year to year regarding the land to be chosen, the cultural procedures, and the handling and marketing of the crop.

CHANGING THE SEED

One of the more serious of the popular errors in cotton production is the belief that it is necessary to change the seed, which usually means changing the variety. Even in districts where good stocks of seed of a superior variety have been established, outbreaks of the seed-changing mania are likely to occur after any unfavorable season, and noticeably inferior varieties may be substituted on account of the unreasoning pressure for change. Many farmers are so thoroughly grounded in their belief in the necessity of this change that they take it as a duty to be performed regularly every second or third year. Numerous infractions of State quarantine laws have been committed in the Western States by people who took the trouble and risk of obtaining from a distance seed very inferior to that they already had.

The more varieties brought into a community, the more mixing goes on at the public gins and the more crossing in the fields. The more the seed is changed, the more rapidly the seed stocks run out, so that the seed-change idea actually produces the effect that it is supposed to prevent. In reality, there is no basis of fact for any general practice of seed changing. Except as better stocks can be obtained to replace worse stocks, there is no occasion to change. Getting a better seed stock does not mean that the variety must be changed. A livestock raiser buys a superior bull of the same breed, not of some other breed, to improve his herd.

Most of the changes are made without any definite information that any advantage may be expected. The number of new varieties is so great that not all of them can be tested adequately in the different sections of the Cotton Belt, and most of them have passed their popularity and have been discarded in the time it would take for such tests to be carried through properly and under a range of seasonal conditions. All such tests show that the yield relations of the varieties differ with the seasons. A variety very prolific in a good season may shed more and yield less in a bad season than a variety less prolific under other conditions.

The seed sellers defend their policy on the ground that the public expects novelties and will pay high prices only for new kinds of seed, which it is their business to supply. But this supposed need comes from the education which for many years the seed dealers have been giving the public. If the cotton growers generally were correctly informed they would be more willing to pay for really select stocks of good and well-known varieties and they would demand fewer untried novelties. It is scarcely ethical to misinform the public in these matters and no practical purpose is served by catering to those already misinformed.

Several cotton varieties such as Trice, Columbia, Durango, Meade, Lone Star, and Acala, have been developed by the United States Department of Agriculture and used extensively but not so extensively as their qualities warrant. State institutions and private breeders have developed and distributed seed of these varieties, but without the extensive advertising that many of the private stocks have received.

If the precautions needed to maintain good stocks of seed are applied continuously, the stocks can be maintained over long periods of years. No matter how uniform a seed stock may be made by careful selection, it does not remain uniform unless the selection is continued, and the stock is isolated from other varieties to prevent crossing. Varieties do deteriorate if these precautions are neglected, but no advantage is to be expected merely from changing the seed. If new seed is to be of any value it must come, not from a place where the seed-changing theory has been followed, but from a locality where one variety has been grown, isolated, and selected for a number of years. To make permanent progress in improvement of varieties and seed stocks it is necessary to get away from the idea that changing the seed has any virtue in itself.

PLANTING TOO MANY VARIETIES

The number of cotton varieties is out of all proportion to practical needs. Names of about 1,200 have been recorded in the United States, and of these about 400 have been added in the last decade, indicating that two or three dozen new varieties appear every year. A total of 438 names was reported through a questionnaire in 1924, but probably that list was far from complete. From one of the cotton States 140 names of varieties were reported. Some were found to be different names for the same variety, but even with such deductions there probably are between 200 and 300 different varieties, most of which are superfluous. Probably a dozen varieties would serve all the purposes of production better than the existing multiplicity.

Certain varieties of cotton have been shown by experiment to have a very wide range of adaptability to different conditions of growth. Several series of varieties represented by the same stocks of seed have been planted during a period of several years, in widely separated localities. A number of varieties, such as Mebane, Lone Star, Durango, and Acala, that were bred or acclimatized in Texas, have grown normally and produced high yields under many different conditions across the entire Cotton Belt, from southern Virginia, North Carolina, and South Carolina, to the irrigated valleys of New Mexico, Arizona, and California. The Durango cotton was very prolific in the Imperial Valley of California and also produced yields of a bale to the acre near Norfolk, Va.

Endless variations can be found in cotton plants, and breeding new varieties would be relatively easy if any practical object were served by multiplicity of kinds. But after a new stock is bred a much more difficult task is encountered; that of determining whether it is superior or inferior to the parent type.

Many new varieties are put out merely to meet the demands of persons who believe that the seed should be changed frequently, and

who, without reasonable precaution, frequently buy seed that has never been tested and for which no assurance of value can be given. The unsupported statements of seed sellers are often credited, even by farmers who in other matters may be considered very cautious and intelligent. The usual reason that the farmer gives in such cases is that he decided to try the seed, though as a rule he had no idea of making any real test. The new seed may be sown with other cotton or in a separate field, from the success or failure of which the farmer may form a favorable or an unfavorable opinion, although the result usually depends much more upon the land or the season than upon any real determination of value.

CONFUSION IN FARM PRACTICE

The needless multiplicity of varieties not only is wasteful and injurious from the standpoint of seed mixing but tends to carelessness in cultural operations. The effects of cultural and seasonal conditions are generally confused with differences between varieties. A farmer who is disappointed with his crop resolves at once to change his seed and does so instead of recognizing that he may have chosen the wrong land or applied wrong methods in growing his crop.

Much greater interest and progress in the improvement of cultural methods are evident in communities that have adopted the plan of growing only one variety. Farmers in such communities, knowing that they have planted the same seed as their neighbors, are aware that other factors are responsible for differences in the behavior of the plants or in the yields and begin to profit by such knowledge. Cotton farming is not on a scientific basis until the confusion regarding varieties is cleared up, so that differences due to growing conditions are not mistaken for varietal characters.

FAILURE TO TEST VARIETIES

Repeated comparisons of cotton varieties are necessary in order to avoid being misled by irregular conditions. Even if the same kind of cotton is planted in uniform soil, adjacent rows often show marked differences in yields, which would be entirely misleading if the rows represented different varieties.

Under the present method of testing cotton varieties, comparisons are made between only two varieties at a time, the two kinds being planted in alternating 4-row blocks, usually three 4-row blocks of one variety and four of the other, and two guard rows added to the outside blocks. The rows usually are 300 feet or more in length, and at picking time the field is divided across, normally into three sections of 100 feet each, and each section of each row is picked, weighed, and recorded separately. With the yields of the different row sections thus recorded, it is possible to judge the regularity of the conditions and to decide whether consistent differences between the varieties have been shown.

Each of these tests affords numerous direct comparisons between the two varieties or methods that are included. The value of a particular test is determined by seeing whether the behavior of the varieties was consistent, rather than from general totals or average yields, which sometimes are misleading. If consistent differences

are not shown in the several comparisons that are made, the only conclusion to draw is that the conditions were too irregular or that the yields were too nearly alike for definite differences to be determined under the conditions of the experiment.

Only a few varieties have been carefully tested in this manner, because the need of making such tests was not understood in the past. General recognition of that need would, of course, seriously interfere with the marketing of any such numbers of novelties as now are brought forward annually by the seed trade. Although few farmers are in position to undertake such thorough variety tests for themselves, the nature of the tests should be known more generally because they are the only means of protecting individuals or communities against ill-advised changes of varieties or seed stocks. An eloquent and irresponsible seed seller can often do considerable damage where a community leader or a wealthy landowner proves susceptible. Cases are known where seed stocks carefully bred and tested for years have been summarily replaced by untried novelties without even a subsequent comparison of the stocks to determine whether any advantage had been gained.

Any stock that is developed from a productive plant is likely to be productive, but not necessarily more so than the parent stock. The productiveness of the selected individual may have been accidental and not inherited or transmitted. Many such selections prove to be less productive, and very few are found to be more productive, when they are increased as progenies and carefully compared with the parent stock. Selection must be maintained, in order to keep up the yields of productive varieties; but claims of higher yields for new kinds of cotton are not to be accepted without the evidence which can be provided only by thorough tests.

MISLEADING CLAIMS FOR VARIETIES

Many misleading claims are used to assist the sale of seed of new varieties that have no real reason for being offered to the public, and the little attention given by the growers to the characters and behavior of the plants in the field is shown by the many forms of obvious misinformation that find credence. High lint percentages are often claimed as an invariable feature, whereas the same variety will show a wide range of percentages when grown in different localities or even in the same place.

The early and late season bolls produced on the same plant may show notable differences in percentage of lint, as well as in the length and strength of the lint, if the plants have been exposed to stress conditions. Even under the best conditions, no kind of cotton is entirely uniform in fiber length, as short fibers (substaple) are always to be found among the full-length fibers.

Merely by the advertising of a variety as five lock, farmers are led to believe that this is a constant character and that all of the cottons that produce 4-lock bolls are mixed and inferior. In reality no kind of cotton has an invariable number of locks in the bolls. Some of the upland varieties have higher proportions of 5-lock bolls than others, but in any variety the proportions are found to vary with the conditions.

Many so-called "cluster cottons," with very short-jointed fruiting branches, have been advertised and sold as very productive new varieties. They appear very fruitful because the cotton shows in large masses where the bolls are crowded together, and sometimes they produce large crops under favorable conditions. None of the cluster cottons has attained more than temporary popularity, as the yields are very irregular, and many of the plants are entirely sterile under unfavorable conditions. A detailed study has shown the cluster habit of growth to be a result of abnormalities in the formation of the branches. This explains the tendency to sterility, which apparently is a general feature of the cluster cottons.

PROPAGATING HYBRIDS

The idea of crossing different varieties of cotton in order to develop superior new kinds is met with occasionally, though many such experiments have been made without producing results of practical value. Hybrids of plants that can be propagated by buds or cuttings often are valuable, but the biological problems are different with plants that have to be grown from seed. Large numbers of crosses of upland varieties with Sea Island and Egyptian cottons have been made and carried through many generations without the breeders being able to establish uniform strains. The first-generation plants are very vigorous and productive, while the second and later generations show many degenerate and infertile individuals and some that are completely sterile.

PLANTING UNSUITABLE LAND

For lack of other crops that can be sold for cash or serve as security for loans, many farmers are compelled to plant cotton on land that affords little prospect of a profitable return. The crop-loan system often allows the dependent farmer no alternative, and thousands of poor-land farmers are producing cotton from year to year for a bare living. More diversified farming and smaller acreages in cotton are strongly advised in some districts, and more care generally should be given to avoiding land that is too poor or too rich, too wet or too dry, for cotton to yield well. Very rich land in some districts has the serious disadvantage that luxuriant, overgrown cotton requires a longer season to mature its crop, and hence is more exposed to weevil injury and to frost damage in short seasons. Wet land remains cold and makes for a slow growth in the spring and late opening of the bolls in the fall.

Rotation, green manuring, terracing, or other precautions to maintain or improve the soil must be considered long in advance, and land that is not in good condition should be avoided. Usually the effort and expense required in preparing the soil and planting and cultivating cotton on unsuitable land are the same as for raising a good crop on suitable land.

PLANTING TOO EARLY

Losses are often invited by planting too early. Farmers are urged to plant early to avoid weevil injury, but even in this matter discretion is desirable. No advantage is gained by crowding the season.

The farmer who plants very early knows that he runs the risk of having to plant again, but the cost of replanting is not the greatest loss that can occur. The young seedlings may be stunted by long periods of cold weather, may lose time in recovering, and some of the plants may be permanently dwarfed. The weakened seedlings may die successively until the stand is badly reduced but too late for replanting to be undertaken. In many instances later plantings have been more productive than early plantings, including formal side-by-side comparisons in weevil-infested districts.

The greatest protection against weevil injury undoubtedly could be obtained in communities or districts that planted all their cotton as nearly as possible on the same date, chosen with reference to the best growth and fruiting of the plants. There is no apparent reason for choosing an extra early date. Under such an arrangement there would be no need to take the hazards of extra early planting. It is true that relatively few communities in the weevil-infested regions have developed forms of organization that would bring about practically simultaneous planting. More extensive cooperative organization among cotton growers is expected in the future, and greater protection against the boll weevil is one of the purposes that such organizations may serve.

The need of caution and the advantages of simultaneous planting in organized communities are recognized in the recommendations of the Cotton Council,[4] as follows:

> Delay planting until danger from frosts and cold is past and the soil is warm enough to give prompt germination and vigorous early growth. Plant 1 bushel or more seed per acre. A perfect stand is immensely important. As nearly as practicable all cotton in the same community should be planted at the same time and in the same variety.

THINNING TOO EARLY

Cotton often is chopped or thinned too early, to the detriment of the young plants or the loss of a stand. No advantage has been shown in chopping before the plants are at least 5 or 6 inches tall. If any adverse conditions such as cold winds or blowing sands are encountered in the early stages of growth, the plants are more protected and make better growth if they remain in a close stand than if they are exposed by early thinning. Rather late thinning, after the plants are 8 or 10 inches high, may be found desirable where cotton grows very rank and produces too many vegetative branches. If the plants are left close in the rows there is less occasion for thinning to be deferred.

SPACING TOO WIDE

The spacing problems have had close attention since the arrival of the boll weevil, and a general change to closer spacing has taken place, though millions of acres still are thinned too wide. Most of the State experiment stations advise close spacing, with the hills

[4] The Cotton Council was organized in the U. S. Department of Agriculture in 1922, under the general direction of the Assistant Secretary of Agriculture, for the purpose of coordinating the department's activities in relation to cotton and assisting the State colleges and experiment stations in a comprehensive and coordinated program of improvement in cotton production in the United States.

10 to 14 inches apart and two or three plants in a hill—in some States even four or five plants. The usual advice is to leave the hills a hoe width apart, which brings the centers of the hills about a foot apart. Previous to the arrival of the boll weevil the farmers were advised to space cotton much wider, 15 to 20 inches or even 2 feet apart in the rows, in order to allow a full development of the individual plants.

At first it was supposed that the breeding of the boll weevil could be restricted by spacing the plants still wider apart, but later it was found that the branching habits of the plants could be controlled by closer spacing, which rendered wide planting unnecessary. The spacing problems can not be clearly understood until it is recognized that the cotton plant has two kinds of branches which are entirely distinct in structure and function. The joints at the base of the main stalk of the plant produce vegetative branches which function as secondary stalks, while joints farther up the main stalk produce fruiting branches.

The vegetative branches, or secondary stalks, may grow nearly as tall as the primary stalk, and if many such branches are produced they may fill all the space between the rows. In fields of large, spreading plants the ground is completely shaded, a condition that invites the greatest damage from the boll weevil. The opposite condition, with the greatest possible surface of the soil exposed to the heat of the sun, is needed for protection against the weevil. The summer generations of weevils develop in the infested flower buds or squares, which fall off and lie on the ground, being shed a few days after they are punctured by the weevils. Thorough drying of these fallen buds by the heat of the sun is fatal to great numbers of the weevil larvae.

Keeping the lanes open between the cotton rows is desirable, not only to kill as many of the weevil larvae as possible but for several other reasons. Even where there are no boll weevils it may be important to have the crop develop as rapidly as possible, to meet short-season conditions.

Leaving the plants close together in the rows has the effect of suppressing the vegetative branches. The number of plants is increased, but their size is reduced, not necessarily in height, but through the lack of vegetative branches, or side stalks, as they are sometimes called, and the individual plant is restricted to the single main stalk. Keeping the lanes open allows the row space to be used more intensively, and the larger number of plants more than compensates for the restriction in size. More flowers are produced and more bolls are set early in the season on rows of close-spaced plants than on equal rows of larger, wide-spaced plants. The development of fruit on the vegetative branches, or side-stalks, necessarily is later than on the main stalk, and the effect of close spacing is to substitute main stalks for side stalks.

If the cotton grows rank and the plants have many side stalks, the lower fruiting branches are likely to be smothered, or if early bolls are developed they are likely to be rotted or mildewed under the heavy canopy of foliage that forms a continuous covering in fields of rank cotton. Under this condition there is little prospect of harvesting an early crop. Even where there are no boll-weevils, fields that are smothered under heavy foliage may produce little or no

cotton, as the crop is borne late in the season and may not mature before frost. Where weevils are present in rank-growing cotton the setting of late bolls is out of the question, and the crop is a complete failure.

Closer spacing of the plants tends to restrict the rank growth which is an undesirable feature in late-planted cotton. When the seedlings develop in hot weather the plants take a different form, with more vegetative branches and less tendency to set fruit promptly. Hence late-planted cotton especially needs to stand close in the rows, to restrict the size of the plants.

The spacing problem is obscured by some writers who do not recognize the facts of the structure and behavior of the plants but who argue on false premises. It may seem reasonable to suppose that spacing the plants farther apart would be the practical way of keeping the fields more open to the sun, but when the formation of the vegetative branches is understood, the apparently logical conclusion gives way to the facts about the method of controlling the branches.

The following summarized advice to farmers regarding the spacing of cotton was issued by the Georgia Agricultural Experiment Station in Press Bulletin 311, Cotton Chopping Facts for Georgia:

> Georgia cotton growers are losing thousands of dollars every year because of poor stands or too few plants per acre. * * * The old pre-boll-weevil practice of cutting out all but one or two plants in the hill and leaving from 2 to 3 feet of space between plants is not recommended for 1930. * * *
>
> *Unthinned or nonchopped cotton.*—During some seasons cotton left just as it comes up will yield as much as spaced cotton. Where less than 1½ bushels of high-germinating seed are used on each acre enough thinning can be done by running a drag harrow across the rows. In the northern part of the State and elsewhere where a poor stand requires planting over it is often best to leave all the plants except those that must be plowed up in removing weeds and grass. During 1929 on the station farm cotton planted over May 15 and left unthinned produced as much as spaced cotton. Only about one-half as much time is required to merely remove weeds and grass as it takes to thin the plants to two per hill with hills one hoe width apart.
>
> *Hoe-blocked cotton.*—Where the plants are very thick in the drill it is usually advisable to thin by removing all the plants in every other hoe width of the row; that is, the plants in one hoe width are left and the next hoe width are cut out. This operation requires very little time as compared with the common tedious method of chopping. Even if a half-dozen plants are left in a hoe width, tests have shown that the yield will justify this labor-saving practice. Hoe blocking is ample thinning for the average field.
>
> *Two plants, one hoe width.*—Cotton farmers are not justified in having less than two plants to each hill and hills more than one hoe width or about 1 foot apart. Fewer stalks than this may look better in the field, but actual trials favor closer spacing.

PICKING TOO LATE

Leaving the cotton too long in the fields before picking is a cause of extensive damage to the crop. It is customary to pick cotton more promptly in the eastern districts of the Cotton Belt where rains are more frequent and often do serious damage to the fiber. Formerly it was customary to make three or even four pickings, but with increased costs of labor the tendency has been toward fewer pickings.

Where no rain is expected, in the drier short-season districts, the cotton often is left in the fields until the end of the season, and only a single picking is made. This is considered to be one of the advantages of production in the dry regions, but there is always a risk

of rainy weather that will soil and stain the cotton. Even if no rain falls, cotton left in the fields for two or three months after the bolls are open undoubtedly is affected to some extent by exposure to the sunlight and the dust storms. A little rain, that might do little or no damage to clean cotton, may be definitely injurious following a dust storm, to say nothing of the cotton that is whipped out and lost, as shown in the title-page illustration. Some of the storm-proof upland varieties hold the seed cotton remarkably well in open bolls for long periods, but too much reliance should not be placed on this fact to justify late picking.

The late-picked cotton generally is considered inferior to the early crop and shows a different character, often described as "soft." Differences of behavior in ginning and baling of early-picked and late-picked cotton are recognized, especially in the irrigated valleys where some of the cotton is left in the fields for the longest periods. The late-season fiber is more bulky in relation to its weight than is the early-season fiber, so that late-season bales often fall below 500 pounds, while early-season bales often run above 500 pounds. No doubt some physical difference or change in the character of the cotton is the reason for the greater bulk of the material later in the season.[5]

BREEDING WEEVILS IN THE FALL

Millions of acres of cotton land breed weevils in the fall, where the plants are left in the fields after the crop is harvested. The northern areas usually are reached by frost before the cotton is picked, or even before all of the bolls are open, but in the long-season southern districts the weevils are given an entirely unnecessary opportunity to breed late in the fall. Even as far north as Charleston, S. C., two or three months may elapse between the last picking of the cotton and the first killing frost. In the more southern areas frost may not come until Christmas, or in parts of Florida and Texas the entire winter may pass with little or no frost. With the weevil present, there is no possibility of a late crop being matured in any of the humid districts, but the plants continue to grow, and the weevils continue to breed in the flower buds, so that in the late season the weevil population is recruited to pass the winter.

The need of clearing the fields promptly at the end of the picking season and thus putting a stop to the breeding of the weevils has been recognized almost from the first days of the weevil invasion as "the most important step in the control of the boll weevil," though generally this practice is followed only in a desultory way. To obtain the full advantage, entire communities need to be organized, so that all of the fields can be cleared at an early date. W. D. Hunter said:

> Concerted action in fall destruction is, of course, desirable. The greatest benefit will result only when whole communities adopt the method. But no planter should hesitate on account of the indifference of his neighbors.

Usually it is found on local inquiry that a few of the more progressive farmers clear their fields early in the season, or that this was done in former years. Such efforts, however, are not likely to con-

[5] This difference was pointed out in a communication from S. H. Hastings.

tinue if the progressive farmer is surrounded by careless neighbors, since the advantage from clearing the fields is not shown in a definite way. The fields that have been cleared may appear to have as many boll weevils the following season as those that are not cleared, so that arguments are not conclusive, and early clearing is not established as a general practice.

The advantage to be gained by concerted action is illustrated by natural occurrences. In Texas and Oklahoma dry weather may prevent the breeding of weevils in the autumn months. If the drought is sufficiently severe to stop the growth of the cotton plants, large areas may be free of weevils the following season. The weevils may be practically destroyed by an invasion of leaf worms, which eat all the leaves and tender growth of the cotton, including the flower buds and young bolls where the weevil larvae can develop, so that no late-season weevils are bred. All the cotton fields in an entire district may be cleared by the leaf worms, and in such cases an absence of weevils is noted the following season.

In the lower Rio Grande Valley, in southern Texas, it is customary to clear the cotton fields in August, in order to plant winter vegetables. The boll weevil is less of a menace in districts where the early clearing of the fields is more generally practiced.

When the weevils are allowed to continue breeding in the fall, there are more of them to pass the winter and the late-season broods go into winter quarters still young and vigorous and with much greater chances of survival. The Bureau of Entomology, in a series of experiments, has shown a much greater mortality among weevils deprived of food early in the fall.

If, by agreement in a community, all fields are cleared by the middle of October, only a remnant of the weevil population might survive to go into winter quarters and fewer yet would be able to emerge and attack the cotton in the spring. Such concerted action against the weevils in the fall might be especially important in the warmer districts which have a longer period between the cotton harvest and the first killing frost.

To be really effective such action must be taken by all growers, and it is difficult to bring this about. Even where most of the farmers are ready to make a concerted movement a few irresponsible individuals may discourage or prevent a general effort. It may not be feasible to organize a community for weevil protection alone, but such protection is one of several benefits possible through community organization. Undoubtedly it is only lack of knowledge of the facts on the part of the farming public that prevents such measures being taken.

MIXING SEED AT PUBLIC GINS

While the modern equipment of the public cotton gin is mechanically superior to the small plantation gins used before the Civil War, the mechanical development in ginning has brought new problems into the cotton industry. Using their own plantation gins, planters who practiced seed selection could keep their own seed stocks unmixed, but the present-day public gin mixes the seed of an entire community.

Past efforts to improve the quality of ginning have been handicapped by lack of scientific information and by the number and

complexity of factors in both the seed cotton and the ginning process. Scientific study of ginning problems has been impeded by lack of adequate facilities for controlling ginning conditions and by lack of suitable methods of measuring the effect upon the ginned lint of variations in the seed cotton and in the ginning process. The Bureau of Agricultural Engineering has established at Stoneville, Miss., a cotton-ginning laboratory designed and equipped for experimental work, and important developments in fiber analysis have been made in connection with the cotton standardization work carried on by the Bureau of Agricultural Economics.

In the absence of such laboratory facilities, manufacturers have placed their equipment in the field to be tried out and have relied upon cotton classing for indications of the commercial characteristics of the resulting product. Progress which they have made under these conditions is a tribute to their judgment and ingenuity.

The construction and operation of the gin machinery are such that extensive mixing of seed is very difficult to prevent under the usual conditions of production with one variety of cotton often following another at the gin. Each wagon load of cotton lined up at a public gin may contain a different variety. (Fig. 1.) Under the usual methods of operation, from 1 to 2 bushels of seed remain in the seed roll of each gin stand, to be mixed with the seed of the next customer. Careful tests have been made to determine the extent of this mixing. The seed rolls were taken out and dyed red so that the seed that had been left in the gin could be definitely identified in the subsequent operation. (Fig. 2.) A farmer who takes one bale to the gin receives an admixture of about 26 per cent of seed from the cotton of his predecessor. Even in the second bale an admixture of 1.6 per cent is present.

Though still generally disregarded, this condition undoubtedly is responsible for the general mixing and mongrelizing of seed stocks. With plants of different kinds in the fields, the character of the fiber is essentially uneven. The general absence of precautions against mixing means that practical quantities of good seed are to be had only in single variety communities.

The conditions of community production are sometimes approached without any formal organization of the farmers, through the influence of a prominent seed grower. At Lockhart, Tex., the late Alexander Mebane developed the Triumph variety, later called Mebane, and maintained a stock of pure seed for many years. But no widespread or permanent improvement is to be expected from individual efforts without community cooperation. Precautions can be taken to avoid gin mixing with small quantities of seed, but are not feasible on a large scale. It is more practicable to restrict the production in a community to one variety than to keep the seed stocks of different varieties separate, which has not been done effectively on a practical scale, though often attempted.

Even gin equipment that would avoid some or all of the present mixing of seed at the gin would not completely solve the problem of maintaining uniform seed stocks. Cross-pollination would still go on as long as different kinds of cotton were planted in adjacent fields, or even in the same neighborhood. The cotton pollen is not blown by the wind but the honeybees are known to range commonly for a mile

or more from their hives, to say nothing of the wild bees, wasps, and other insects that in some districts visit the cotton flowers in large numbers. The only effective way to prevent the mixing of seed at public gins and in the field is to have separate communities that grow only one variety of cotton.

FIGURE 1.—Farmers waiting at a public gin. Each wagon may contain a different kind of cotton

GINNING TOO CLOSE

Cotton is commonly ginned too close, in order to take off short fiber and fuzz from the seed coat, and thus to increase the weight of the bale. Too close ginning is one of the consequences of indiscriminate buying. With the buyers paying the same price for all the cotton, the farmer naturally wishes to have his bales weigh as much as possible, and insists that the ginner shall give him a high turnout.

If cotton were sold on its merits in the primary markets the farmers would soon recognize that its quality is impaired by close ginning. They would understand that high turnouts are obtained

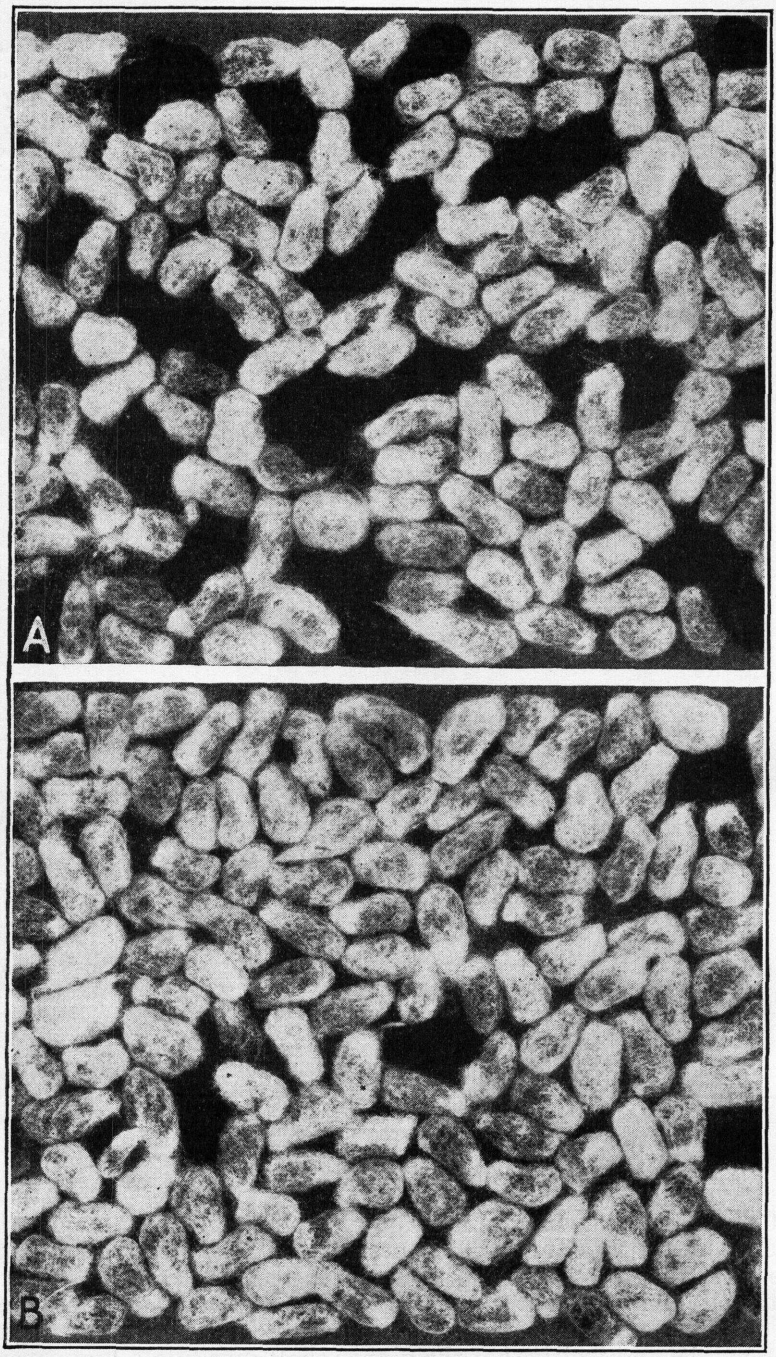

FIGURE 2.—An experiment to determine the extent of seed mixing at public gins. The seed roll was taken out, dyed red, dried, and replaced, and ginning resumed. The frequency of red seeds after 10 minutes is shown in A, and after 20 minutes in B. Even in the ginning of the second and third bales red seeds were found

by including in the cotton lint a part of the fuzzy covering of the seed consisting of very short fibers, of no use for spinning, and constituting in reality only an adulterant in the bales. Indeed, the fuzz and short fibers are worse than useless to the manufacturer, since they not only constitute "waste" at the mills, but also require costly mill processes for their removal.

Usually the turnout, or percentage of bale weight to seed cotton, is the only item of definite information that the farmer obtains regarding his crop and the only feature in which he takes an active interest. If not satisfied with the turnout received at one gin, the farmer will go to another, or will change his seed, in the belief that the variety has run out.

As long as the custom holds of buying all cotton at the same price in the local markets, the ginners will continue to prepare the fuzz-laden, high-turnout bales that the farmers think they must have in order to get the full return for their cotton. The flat-price system invites adulteration by the farmer, both by growing inferior cotton and by having it ginned badly, with the maximum of "buzz-fuzz" and seed fragments included to increase the weight of the bales. The only improvement to be expected is through change in the buying system, so that higher prices can be paid for bales that are not adulterated with linters.

Close ginning is seen to be definitely undesirable with cottons of good quality and length of staple, in markets where good cotton is recognized and bought at a premium above the short staples. Such cotton loses in grade and value from the presence of fuzz and neps. The farmers then ask to have their cotton ginned "for staple" instead of "for turnout." Gins in some districts are equipped for giving the farmer what he wants. If the cotton is ginned for staple, the linters can be left out, while farmers who order turnout are served with more linters and trash in their bales. Buyers of good fiber avoid the high-turnout bales, which they know have been charged at the gin with linters and other waste. By close ginning, 10 pounds of linters may be added to a bale, and at 20 cents a pound this would bring the farmer $2. But if the addition of the linters keeps the bale from being sold for 21 or 22 cents a pound, so that a net loss of from $3 to $8 per bale is involved, close ginning no longer appears as an advantage to the farmer, and he is willing to change his policy. In communities where good cotton is being grown, careful ginning is a matter of great importance in preparing the crop for market.

Grading as well as classing has been arbitrary or casual in primary markets until recent years. Trashy or stained cotton has been penalized, but higher grades are seldom recognized in the primary markets. Only an increased weight of the bale was likely to bring a higher return to the farmer.

GINNING TOO WET OR TOO DRY

Putting wet cotton through the gins is another cause of loss, induced by the lack of discrimination of quality in the primary markets. The ginners generally are aware of the injury that is done by operating on wet cotton, but they are unable to refuse service, as this may drive their customers to other gins. A general need exists for

artificial drying facilities, and this problem is receiving attention in the Bureau of Agricultural Engineering.

Cotton ginned while damp is often described as "gin cut" and is recognized by the dense flakes sometimes called "naps" or "locks," formed by the wet fibers packing around the saw teeth. These naps are distinct from the neps that are increased by close ginning.

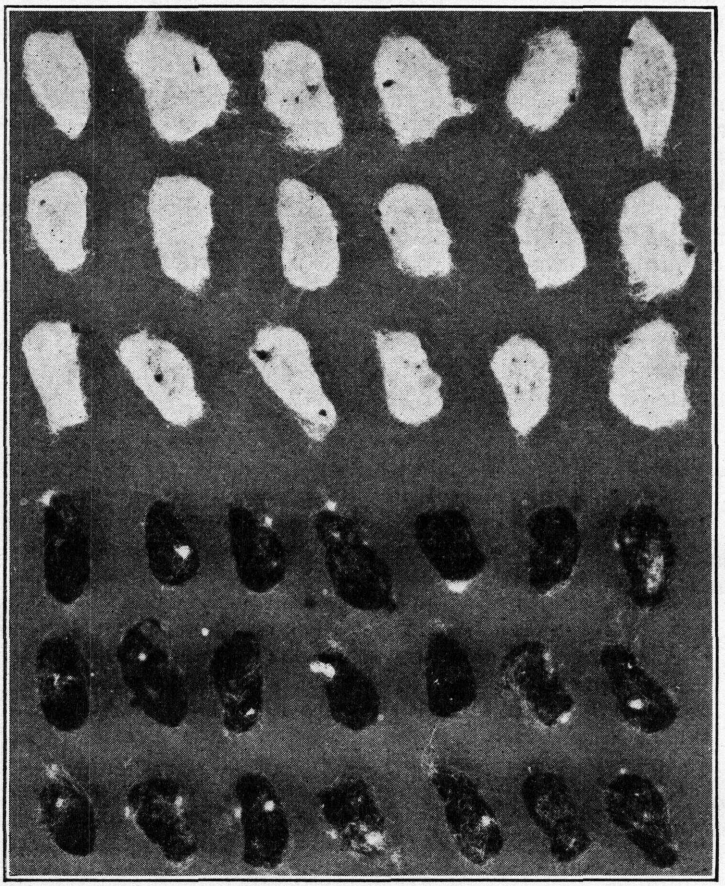

FIGURE 3.—Production of neps in ginning. Ginned seeds were dyed red and placed in the seed roll with undyed cotton. After ginning had been continued, many red neps appeared, which undoubtedly were formed from the fuzz of the dyed seeds. Some of the red neps are shown in the photograph as black spots against the white fuzz of the uncolored seeds on white seeds, and many of the usual white neps are shown on the colored seeds

In the more humid sections of the Cotton Belt it was customary to dry and store the cotton before ginning, so that a uniform condition of moisture was reached. The old plantation gins in the Southeastern States had drying floors for spreading out the cotton, and public gins were sometimes provided with storage bins, but such precautions are practically unknown in the drier sections of Texas and other Southwestern States. Even in these districts gins should have facili-

ties for artificial drying, because rainy weather sometimes does serious damage.

Cotton that is very dry may show many neps, if ginned at very high rate of feed, especially when a high saw speed is used. Though the fiber may not be injured, the commercial value may be impaired if too much fuzz comes off with the lint. It appears that when the seeds are very dry and brittle more small particles of the seed coats are chipped out by the saw teeth. The particles of seed skin with a few of the fuzz fibers attached are the neps which are most objectionable to the spinners, as they are most difficult to separate. An experiment made by J. S. Townsend at the United States Cotton Field Station, Shafter, Calif., demonstrates the formation of neps by separation of small tangles of fuzz from the seeds in ginning. (Fig. 3.) The neps and loose fuzz apparently are most abundant in cotton that has been checked by drought, so that many of the seeds are aborted and shriveled. Observations reported by Mr. Townsend indicate that drying and shrinkage of the seeds may loosen the seed coats so that more of the fuzz and neps are detached in the ginning process.

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